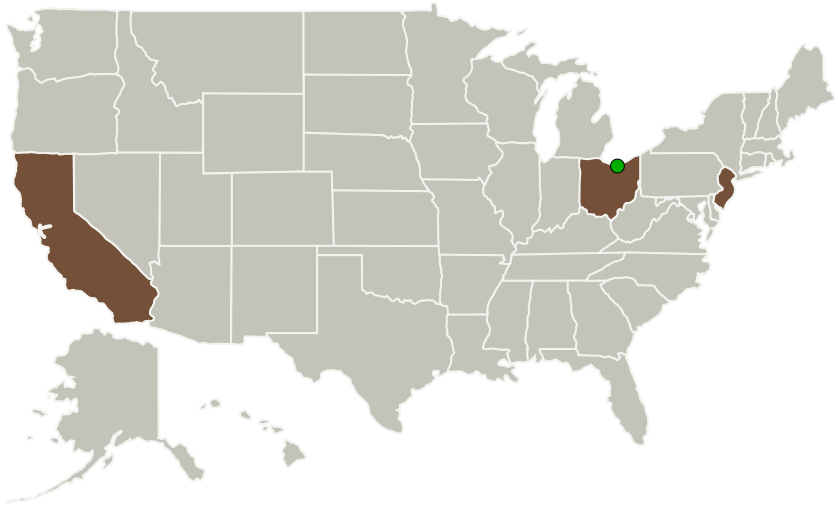
High Capacity and High Voltage Composite Oxide Cathode for Li-ion Batteries, Phase II

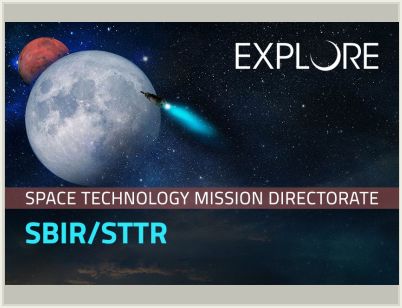
Completed Technology Project (2010 - 2013)

Project Introduction

Currently used cathode materials in energy storage devices do not fully satisfy the power density and energy density requirements for NASA's exploration missions. Working in collaboration with our STTR partner at University of California ⬌ San Diego, we propose to develop layered-layered composite cathode materials that offer superior performance over commercially available positive electrode materials such as, LiCoO2, or LiNi1-xCoxO2. This includes delivering high discharge capacity and high energy density, which significantly reduces the volume and mass of the battery pack. To date, through innovations in the structure and morphology of the composite electrode particles, we have successfully demonstrated an energy density in excess of 1000Wh/kg (at 4V) at room temperature. The objective of the Phase II program is to enhance the kinetics of Li-ion transport and electronic conductivity at low temperature (T=0 C) so as to meet the target performance set by NASA. This is being done through modifications to the atomic structure as well as the surface of the cathode particles. This will allow us to (i) maintain high energy and power densities at low temperature, (ii) lower the first cycle irreversible capacity loss and improve the efficiency, and (iii) further stabilize and enhance the safety of the cell. The practical implication of the R&D in Phase II is that it will lead to an advanced and robust energy storage system. By the end of the Phase II program, this next generation cathode material will be ready for implementation in NASA missions for powering the Altair Lunar Lander, Lunar EVA spacesuit and Lunar Surface Systems. The capabilities developed in this program will enhance NEI's abilities to service the US Li-ion battery market with specialty electrode materials.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
NEI Corporation	Lead Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
University of California-San Diego(UCSD)	Supporting Organization	Academia	La Jolla, California

Primary U.S. Work Locations	
California	New Jersey
Ohio	

Project Transitions

August 2010: Project Start

April 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139045)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

NEI Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

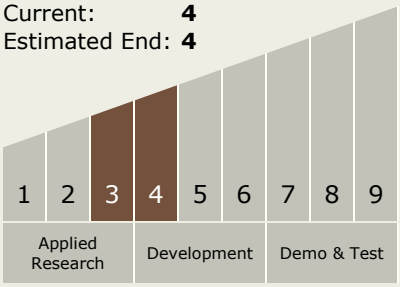
Carlos Torrez

Principal Investigator:

Nader Hagh

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System